(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
23 October 2003 (23.10.2003)

PCT

(10) International Publication Number
WO 03/088601 A1

(51) International Patent Classification[7]: H04L 12/56

(21) International Application Number: PCT/KR03/00688

(22) International Filing Date: 7 April 2003 (07.04.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10-2002-0018888 8 April 2002 (08.04.2002) KR

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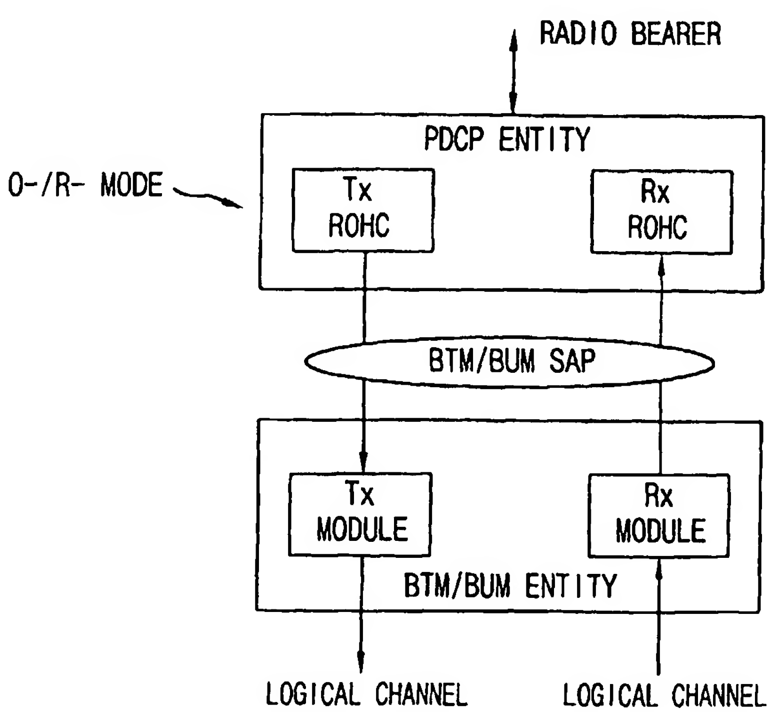
(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:
— *with international search report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: RLC FOR REALTIME MULTIMEDIA MOBILE COMMUNICATION SYSTEM



(57) Abstract: In the method for wireless communication between a terminal and a base station supporting a real time packet transfer service mode and reliable packet transfer service mode according to the present invention, one of the real time packet transfer service mode and reliable packet transfer service mode is selected and a communication channel between the terminal and the base station is established, and the packet data are bidirectionally exchanged between the terminal and the base station over the communication channel in real time.

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MOBILE COMMUNICATION METHOD AND SYSTEM

Technical Field

The present invention relates to a mobile communication system and, more particularly, to an improved mobile communication method and system for supporting a bidirectional real time communication services.

Background Art

A universal mobile telecommunications system (UMTS) is a third generation mobile communication system that has evolved from a standard known as Global System for Mobile communications (GSM). This standard is a European standard which aims to provide an improved mobile communication service based on a GSM core network and wideband code division multiple access (W-CDMA) technology. In December, 1998, the ETSI of Europe, the ARIB/TTC of Japan, the T1 of the United States, and the TTA of Korea formed a Third Generation Partnership Project (3GPP) for the purpose of creating the specification for standardizing the UMTS.

The work towards standardizing the UMTS performed by the 3GPP has resulted in the formation of five technical specification groups (TSG), each of which is directed to forming network elements having independent operations. More specifically, each TSG develops, approves, and manages a standard specification in a related region. Among them, a radio access network (RAN) group (TSG-RAN) develops a specification for the function,

items desired, and interface of a UMTS terrestrial radio access network (UTRAN), which is a new RAN for supporting a W-CDMA access technology in the UMTS.

The TSG-RAN group includes a plenary group and four working groups. Working group 1 (WG1) develops a specification for a physical layer (a first layer). Working group 2 (WG2) specifies the functions of a data link layer (a second layer) and a network layer (a third layer). Working group 3 (WG3) defines a specification for an interface among a base station in the UTRAN, a radio network controller (RNC), and a core network. Finally, Working group 4 (WG4) discusses requirements desired for evaluation of radio link performance and items desired for radio resource management.

FIG. 1 is a block diagram illustrating a general UMTS architecture. The UMTS is roughly divided into a terminal 10, UTRAN 20 and core network 30.

The UTRAN 20 includes one or more radio network sub-systems (RNS) 25. Each RNS 25 includes an RNC 23 and one or more Node Bs 21 managed by the RNCs.

Node Bs are managed by the RNCs, receive information sent by the physical layer of a terminal 10 (e.g., mobile station, user equipment and/or subscriber unit) through an uplink, and transmit data to a terminal 10 through a downlink. Node Bs, thus, operate as access points of the UTRAN for terminal 10.

The RNCs perform functions which include assigning and managing radio resources, and operate as an access point with respect to the core network 30.

The services provided to the specific terminal 10 is roughly divided into a circuit switched service and a packet switched service. For example, a general voice phone call service belongs to the circuit switched service, while a Web browsing service through an Internet connection is classified as the packet switched service.

In case of supporting the circuit switched service, the RNC 20 is connected to the MSC 31 of the core network 30, and the MSC 31 is connected to a Gateway Mobile Switching Center (GMSC) 33 managing a connection to other networks.

Meanwhile, in case of the packet switched service, services are provided by a Serving GPRS Support Node (SGSN) 35 and a Gateway GPRS Support Node (GGSN) 37 of the core network 30.

The SGSN 35 supports a packet communication going toward the RNC 23, and the GGSN 37 manages connection to other packet switched networks such as the Internet.

An interface exists between various network components to allow the network components to give and take information to and from each other for a mutual communication. A cable interface between the RNC 23 and the core network 30 is defined as an Iu interface.

Connection of the Iu interface to the packet switched area is defined as an Iu-PS, and connection of the Iu interface to the circuit switched area is defined as an Iu-CS.

A radio access interface between the terminal 10 and the UTRAN 20 is defined as a Uu interface.

FIG. 2 is a block diagram illustrating a layered radio interface protocol

architecture adopted to the Uu interface in FIG 1. The radio access interface protocol is vertically formed of a physical layer (PHY), a data link layer, and a network layer and is horizontally divided into a control plane for transmitting control information and a user plane for transmitting data information. The user plane is a region to which traffic information of a user such as voice or an IP packet is transmitted. The control plane is a region to which control information such as an interface of a network or maintenance and management of a call is transmitted.

In FIG. 2, protocol layers can be divided into a first layer (physical layer: PHY: L1), a second layer (data link layer: MAC, RLC, and PDCP: L2), and a third layer (network layer: RRC: L3) based on three lower layers of an open system interconnection (OSI) reference model well known in a communication system.

The first layer provides an information transfer service to MAC and higher layers using various radio transfer techniques.

The first layer is connected to the MAC layer through transport channels (TrCHs), and data are transferred between the MAC layer and the PHY layer through the transport channels.

The MAC layer provides a radio resource and MAC parameter reallocation services.

The MAC layer provides data transfer services to the radio link control (RLC) layer through logical channels, and various logical channels are provided for the kinds of data transfer services as offered by MAC.

Each logical channel type is defined by what type of information is transferred. In general, the control plane information is transferred using

control channels and user plane information is transferred using traffic channels.

The RLC layer supports reliable data transmission and performs segmentation and reassembly functions of variable-length upper layer PDUs (RLC SDUs) into/from smaller RLC PDUs.

The RLC SDU delivered from the upper layer is segmented into appropriated size and added by header information so as to be transferred to the MAC layer in the form of RLC PDU. The RLC PDUs are temporally stored in an RLC buffer located in the RLC layer

The packet data convergence protocol (PDCP) layer is located above the RLC layer. A data stream using a network protocol such as an IPv4 (internet Protocol version 4) or an IPv6 (internet Protocol version 6) can be transmitted effectively through the radio interface of a relatively narrow bandwidth by virtue of the PDCP layer.

For this purpose, the PDCP layer performs a function of header compression and decompression using an RFC2507 protocol or RFC3095 (Robust Header Compression (ROHC) protocol defined by the Internet Engineering Task Force (IETF).

With such header compression techniques, only information required for the header part is transmitted so that less control information can be transmitted and thus the amount of data to be transmitted can be reduced.

The RRC layer positioned in the lowest portion of the third layer is defined only in the control plane and controls the transport channels and the physical channels in relation to the setup, the reconfiguration and the release of the radio bearers (RBs).

Here, the RB means a service provided by the second layer for data communication between the terminal 10 and the UTRAN 20, and setting up of the RB means processes of stipulating the characteristics of a protocol layer and a channel, which are required for providing a specific service, and setting the respective detailed parameters and operation methods.

For reference, the RLC layer can be included in the user plane and the control plane according to a layer connected to the upper layer. When the RLC layer belongs to the control plane, the data are received from a radio resource control (RRC) layer. In the other cases, the RLC layer belongs to the user plane.

As shown in FIG. 2, in case of the RLC layer and the PDCP layer, a plurality of entities can exist in one layer. This is because one terminal 10 has a plurality of RBs, and only one RLC entity and only one PDCP entity are generally used for one RB.

The RLC layer will now be described in detail.

The RLC layer can perform functions of segmentation and reassembly for the RLC SDU received from the upper layer. After segmentation and reassembly, the RLC layer can add an RLC header to an RLC payload to construct an RLC PDU.

A header of the RLC PDU may contain a sequence number assigned thereto in the transmitted order of RLC PDUs such that the RLC layer of the receiver checks the sequence number of the received RLC PDU and requests retransmission of the lost RLC PDU from the RLC layer of the transmitter, if any.

There are three operation modes for the RLC layer according to

functions required by the upper layer, and the RLC layer processes the RLC SDUs according to the operation mode selected.

The three operation modes are a transparent mode (TM), an unacknowledged mode (UM), and an acknowledge mode (AM).

When an RLC entity operates in TM, the RLC entity does not add any header information to the RLC SDU received from the upper layer.

In general, the RLC entity operating in TM does not use the functions of segmentation and reassembly, and thereby, the RLC SDU received from the upper layer is transmitted as it is received. However, if the segmentation function is configured by upper layers the RLC entity segments the RLC SDU into several RLC PDUs. In the case that the RLC SDU is segmented and transferred, RLC PDUs derived from one RLC SDU are to be simultaneously transferred.

When the RLC entity operates in UM, the RLC entity segments the RLC SDU into UMD PDUs of appropriate size if the RLC SDU is larger than the length of available space in the UMD PDU.

Each RLC PDU includes header information so that the RLC layer of the receiver can restore the RLC SDU from the RLC PDUs, and the header information may indicate a position where the RLC SDU ends or contain a sequence number of the RLC PDU.

However, the RLC entity does not retransmit the lost RLC PDU in the UM, even if the receiver does not receive the RLC PDU. That is, the RLC entity of the receiver does not request retransmission of the RLC PDU when it does not receive the RLC PDU or the received RLC PDU is erroneous, and the RLC entity of the transmitter does not duplicate the RLC PDU for

retransmission purpose.

Services that can be supported in UM are a cell broadcast service, a voice over IP (VoIP) using an IP network, etc.

Meanwhile, when the RLC layer operates in AM, the RLC entity supports retransmission of RLC PDU when transmission failure occurs.

Whether or not the RLC PDU has been successfully transmitted can be determined by checking the sequence number in the header information of the RLC PDU. If RLC PDU has been lost or erroneous, the RLC entity of the receiver transmits status information (status PDU) indicating the sequences numbers of the lost or erroneous RLC PDU to the transmitter.

When the RLC layer is operated in AM, various timers and counters are defined for a effective retransmission of packets. The timers can be driven after a specific RLC PDU is transmitted, and if no acknowledgement is received in a predetermined time, the RLC entity discards duplicate of RLC PDU and performs a procedure scheduled for this case.

The counter increases by 1 whenever the RLC PDU is transmitted. If no acknowledgement is received in response to RLC PDU even after the counter exceeds a predetermined value, the RLC layer discard the duplicate of the RLC PDU and performs a procedure scheduled for this case.

The RLC entities of the transmitter and receiver set a range of sequence numbers of the RLC PDUs to be transmitted and received, and defines a transmission and reception windows on the basis of the range.

The RLC entity of the transmitter can transmit only the RLC PDUs as much as a window size of the transmission window and the RLC entity of the receiver can adjust or update the window size of a transmission window

according to status information to be sent to the transmitter.

The RLC entity of the receiver receives the RLC PDUs as much as the window size of the reception window and discard the RLC PDUs beyond the window size of the reception window.

FIG. 3 is a block diagram illustrating RLC layer of the layered radio interface protocol architecture of FIG. 2.

As described above, a plurality of RLC entities can be activated in the RLC layer, and each RLC entity operates in one of TM, UM, and AM.

When the RLC entity operates in TM or UM, the data transfer is unidirectional as shown in FIG 3. That is, one RLC entity can only transmit or receive the data in TM or UM, because the retransmission function is not supported in TM or UM.

On the other hand, when the RLC entity operates in AM, the data transfer is bidirectional. This means that the peer AM RLC entities utilizes status information which reports sequence numbers indicating the lost PDUs or erroneous PDUs. That is, the AM RLC entity can simultaneously transmit and receive the data, which means that the AM RLC entity can receive the status information from the receiver while it transmits packets to the receiver.

In detail, since the AM RLC entity includes both a transmission (Tx) module and a reception (Rx) module, it is not defined as the term of a transmission RLC entity or a reception RLC entity like in TM or UM.

In addition, generally, one RB is mapped to one RLC entity, an RB service can be bidirectional or unidirectional according to an operation mode of the RLC entity of the lower layer.

How the packets (RLC PDU) are transferred in respective modes will

be described hereinafter in more detail.

In case of TM or UM, the RLC entity of the transmitter does not support retransmission function such that the peer RLC entity of the receiver transfers the packets to an upper layer upon receiving it. However, in case of AM, the AM RLC entity supports an in-sequence delivery function in that packets are sequentially delivered to the upper layer, so that processing delay occurs for reordering the received packets in the order of the transmitted sequence.

The in-sequence delivery function refers to a function of delivering RLC PDUs containing the RLC SDU data to the upper layer in the order that the RLC entity of the transmitter has transmitted them. The RLC entity of the receiver acknowledges successful reception or requests retransmission of the missing PDUs by sending one or more status PDUs to the AM RLC peer entity through its transmitting side. Once a complete RLC SDU has been received, the associated PDUs are reassembled and then delivered to the upper layers through an AM service access point (AM SAP).

Meanwhile, in order to support an effective real time packet transmission, the PDCP layer is defined for the packet switching (PS) domain. Every PS domain radio access bearer (RAB) is associated with one radio bearer (RB), which is in turn is associated with one PDCP entity. Each PDCP entity is associated with one RLC entity.

Every PDCP entity uses zero, one, or several different header compression protocols. Here, the Robust Header Compression (ROHC) protocol is exemplary adopted as a header compressor.

The ROHC is generally used to compress or decompress header

information of the Real-time transport protocol /User Datagram Protocol/Internet Protocol (RTP/UDP/IP) packet at the transmitting and receiving entity, respectively.

The RTP/UDP/IP packet refers to a packet containing header information added thereto while the user data passes the RTP, UDP, and IP. The packet header includes various information required for routing to the destination and recovering the transmitted data at the receiver.

The RTP protocol is used to supplement a problem when real time traffic such as a Voice over IP (VoIP) and streaming service is transmitted using the UDP/IP protocol layers. The UDP is one of transport layer protocols over IP and supports connectionless data transfer service unlike the Transmission Control Protocol (TCP) which supports connection-oriented service with the retransmission or flow control functions.

IP is a network layer protocol in terms of OSI reference model and is responsible for moving data packet from node to node based on a destination IP address contained in the packet header. The IP supports best effort delivery service so as to try to forward the packets to the destination but not guaranteed successful delivery.

ROHC operates based on the fact that there is significant redundancy between header fields, both within the same packet header but in particular between consecutive packets belonging to the dame packet stream. By sending static field information only initially and utilizing dependencies and predictability for other field, the header size can be significantly reduced for most packets.

For reference, a RTP/UDP/IP packet has an IP (IPv4) header of 20

octets, a UDP header of 8 octets, and an RTP header of 12 octets for a total of 40 octets. With IPv6, the IP header is 40 octets for a total of 60 octets. The size of the payload depends on the coding and frame sizes being used and is as low as 15 to 20 octets.

From these numbers, the need for reducing header sizes for efficiency is obvious. Using the ROHC, the header size can be significantly reduced as much as 1 to 3 octets.

The ROHC has three modes of operation, called Unidirectional mode (U mode), Bidirectional Optimistic mode (O mode), and Bidirectional Reliable mode (R mode).

When the ROHC operates in U mode, packets are sent in one direction only, i.e., from compressor to decompressor. On the other hand, when the ROHC operates in O or R modes, packets are sent in two directions, i.e., a feedback channel is used to send error recovery requests and acknowledgement of significant context updates from decompressor to compressor.

O mode aims to maximize compression efficiency and sparse usage of the feedback channel so as to reduce the number of damaged headers delivered to the upper layers due to residual errors or context invalidation.

R mode aims to maximize robustness against loss propagation and damage propagation, i.e., minimizes the probability of context invalidation, even under header loss/error burst conditions.

FIG. 4 is a block diagram for illustrating peer-to-peer communication between RLC entities operating in UM.

Since the ROHC compressor and decompressor of PDCP peer

entities communicates through a unidirectional link in U mode, each PDCP entity at the transmitter and receiver is mapped to one TM or UM LRC entity.

In FIG. 4, a receiver (UTRAN or UE) and a transmitter (UTRAN or UE) communicate through a Uu interface. A PDCP entity at the transmitter is mapped to a transmit UM RLC (Tx UM RLC) entity through a UM SAP and operates a transmit ROHC (Tx ROHC) in U mode. Also, a peer PDCP entity at the receiver is mapped to one receive UM RLC (Rx UM RLC) entity through a UM SAP.

When a PDCP SDU is received from upper layers, the PDCP entity at the transmitter performs header compression using the Tx ROHC upon reception of the PDCP SDU and submit the PDCP PDU to the Tx UM RLC entity through the UM SAP in the sequence received from the upper layer. On the other hand, when the PDCP entity at the receiver receives the PDCP PDU from the Rx UM RLC entity through the UM SAP, it performs header decompression of the PDCP PDU using the Rx ROHC to obtain the PDCP SDU and delivers the recovered PDCP SDU to the upper layer in the order received from the UM RLC entity.

When the PDCP entities at the transmitter and receiver are mapped to respective Tx and Rx TM RLC entities, the transmitter and receiver operate in the similar manner as in UM.

FIG. 5 is a block diagram illustrating a PDCP entity-RLC entities-mapping structure in which the RLC entity operates in AM.

Unlike UM and TM RLC entities, the AM RLC entity can be configured to utilize one or two logical channels so as to transmit and receive at the same time. Accordingly, the AM RLC entities at the transmitter and

receiver have the same structure and the AM RLC entity at the transmitter will be exemplary described hereinbelow.

In FIG. 5, a PDCP entity is mapped to an AM RLC entity through an AM SAP. The PDCP entity operates in O mode or R mode (O/R mode) and also the AM RLC entity operates a Tx RLC module and a Rx RLC module, which means that the PDCP entity activates a Tx ROHC module and an Rx ROHC module.

When a PDCP SDU is received from upper layers, the PDCP entity performs header compression using the Tx ROHC module upon reception of the PDCP SDU and submit the PDCP PDU to the Tx RLC module of the AM RLC entity so as to transfer to a transmit side logical channel. On the other hand, when an RLC PDU is received through a receive side logical channel, the Rx RLC module of the RLC entity processes the RLC PDU and then delivers the RLC SDU (PDCP PDU) to the Rx ROHC module of the PDCP entity through the AM SAP. The Rx ROHC module performs header decompression of the PDCP PDU and delivers the PDCP SDU to the upper layer in the order received from the AM RLC entity.

In order for the ROHC to efficiently operate, PDCP PDUs need to be quickly transferred from the RLC entity to the PDCP entity. In this respect, the PDCP entity efficiently operates when the PDCP entity is mapped to the TM/UM RLC entity since the RLC entity delivers the RLC SDUs to the PDCP entity upon receiving the RLC SDUs (PDCP PDUs).

However, when the PDCP entity is mapped to one AM RLC entity, the PDCP entity can not operate well, (i.e., in real time) since the AM entity always operates the retransmission function, in which the RLC PDUs can not

be delivered to the PDCP entity until a complete RLC SDU has been received.

Actually, the length of the radio frame specified in UMTS is 10ms, the time taken by the radio frame to reach the receiver is over 50 ms in consideration of the propagation delay and processing delay at the transmitter and receiver.

Typically, maximum tolerable delay time for supporting the voice telephony or streaming services is 80ms. Accordingly, if a packet belonged to the radio frame is required to be retransmitted only one time, the total delay for delivering the packet to the upper layer exceed the maximum tolerable delay time. Thus, mapping the PDCP entity operating the ROHC in O/R mode to the AM RLC entity results in degradation of the real time service quality.

Furthermore, the data communication method has a drawback in that since the one PDCP entity can be mapped to only one TM/UM RLC entity, which operates in only one direction, for supporting real time services, it is impossible to support real time bidirectional services.

Disclosure of Invention

The present invention has been made in an effort to solve the above problems.

It is an object of the present invention to provide an improved wireless communication method and system capable of bidirectionally communicating packet data between a terminal and a base station while the

system operates in a transparent mode (TM) or unacknowledged mode (UM).

It is another object of the present invention to provide an improved wireless communication method and system capable of simultaneously communicating packet data between a terminal and a base station in real time while the system operates in an acknowledged mode (AM).

It is still another object of the present invention to provide an improved wireless communication method and system capable of bidirectionally communicating packet data between a terminal and a base station in real time in all of the packet data transfer modes supported by the system.

To achieve the above objects, the method for wireless communication between a terminal and a base station supporting a real time packet transfer service mode and reliable packet transfer service mode, comprises selecting one of the real time packet transfer service mode and reliable packet transfer service mode, establishing a communication channel between the terminal and the base station, and transmitting, receiving, or simultaneously transmitting and receiving packet data in real time.

The communication channel establishment includes configuring a packet data convergence protocol (PDCP) entity located in a PDCP layer, the PDCP entity being associated with at least one radio bearer, configuring at least one radio link control (RLC) entity located in an RLC layer, and mapping the RLC entity to two logical channels.

The PDCP entity is provided with a header compression function and the header compression function enables a header compressor and header decompressor according to characteristics of the radio bearer.

The header compressor performs header compression upon reception of the packet data from upper layers through the radio bearer so as to generate a compressed header packet and the header decompressor performs header decompression upon reception of a compressed header packet from the RLC entity.

In one aspect of the present invention, the PDCP entity is mapped to one RLC entity. The RLC entity has a transmit side module which transmits the compressed packet from the PDCP entity through one of the logical channels and a receive side module which receives the packet from the lower layer through the other of the logical channels.

The header compressor is mapped to the transmit side module through a service access point and the header decompressor is mapped to the receive side module through the service access point.

In another aspect of the present invention, the RLC entity disables a packet retransmission function.

In another aspect of the present invention, the PDCP entity is mapped to two RLC entities.

The PDCP entity is associated with one radio bearer and one of the two RLC entities is responsible for transmission of the packet received from the PDCP entity through one of the two logical channels and the other is responsible for reception of the packet through the other logical channel.

The header compressor and header decompressor are mapped to different RLC entities through different service access points, the RLC entities being respectively responsible for transmission and reception of the packet.

In still another aspect of the present invention the PDCP entity is associated with two radio bearers of which each has a unidirectional characteristic.

The PDCP entity is mapped to two RLC entities and one of the two RLC entities is responsible for transmission of the packet through one of the two logical channels and the other is responsible for reception of the packet through the other logical channel.

The header compressor and header decompressor are mapped to different RLC entities through different service access points, the RLC entities being respectively responsible for transmission and reception of the packet.

To achieve the above objects, the wireless communication system having at least one communication channel between a terminal and a base station, each of the terminal and base station, according to the present invention, comprises a mode selector which selects one of a real time packet transfer service mode and a reliable packet transfer service mode according to characteristics of a service to be provided to upper layers, and a channel configuring unit which configures the channel between the terminal and the base station based on the service mode selected by the mode selector, wherein the channel configuring unit configures the channel over which the terminal and the base station bidirectionally exchange packets in both the real time packet transfer service mode and a reliable packet transfer service mode.

Brief Description of the Drawings

The invention will be described in detail with reference to the following drawings in which like reference numerals refer to like elements wherein:

FIG. 1 is a block diagram illustrating a general UMTS architecture.

FIG. 2 is a block diagram illustrating a radio interface protocol architecture adopted or Uu interface between the UE and the UTRAN in FIG 1;

FIG. 3 is a block diagram illustrating RLC layer of the radio interface protocol architecture of FIG. 2;

FIG. 4 is a block diagram for illustrating peer-to-peer communication between RLC entities operating in UM;

FIG. 5 is a block diagram illustrating a conventional PDCP entity-RLC entities-mapping structure in which the RLC entity operates in AM;

FIG. 6 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a mobile communication system according to a first embodiment of the present invention;

FIG. 7 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a mobile communication system according to a second preferred embodiment of the present invention;

FIG. 8 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a

mobile communication system according to a third preferred embodiment of the present invention; and

FIG. 9 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a mobile communication system according to a fourth preferred embodiment of the present invention.

Best mode for Carrying Out the Invention

Preferred embodiments of the present invention will be described hereinafter with reference to the accompanying drawings.

FIG. 6 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a mobile communication system according to a first embodiment of the present invention.

As shown in FIG. 6, one RB is associated with one PDCP entity located in the PDCP sublayer and the PDCP entity is associated with one bidirectional TM or UM (BTM/BUM) RLC entity located in the RLC sublayer through one BTM/BUM SAP. The BTM/BUM RLC entity is associated with the MAC sublayer through two logical channels.

The PDCP entity has a Tx ROHC module for performing header compression on a PDCP SDU received from upper layers and an Rx ROHC module for performing header decompression on PDCP PDUs delivered from lower layers.

In the present invention the ROHC protocol is used for header

compression/decompression function of the PDCP entity, however, it is not limited thereto, but, various types of header compression protocols can be used according to upper layer protocols.

The BTM/BUM RLC entity includes a Tx module for transferring RLC SDU received from the PDCP entity to a transmit side logical channel and an Rx module for receiving RLC PDUs through a receive side logical channel.

The Tx ROHC module performs header compression upon reception of the PDCP SDU from upper layers and submits the PDCP PDU(s) to Tx module of the BTM/BUM RLC entity through the BTM/BUM SAP.

On the other hand, when the Rx module of the BTM/BUM RLC entity receives RLC PDUs through the receive side logical channel, the Rx module delivers the PDCP PDU (RLC SDU) to the Rx ROHC module of the PDCP entity through the BTM/BUM SAP. The Rx ROHC module performs head decompression upon reception of the PDCP PDU and then delivers the PDCP SDU to the upper layers.

Since one BTM/BUM RLC entity is provided with the Tx and Rx modules mapped to respective transmit and receive side logical channels, the BTM/BUM RLC entity can support bidirectional communication. To support the bidirectional real time services, the PDCP entity operates the ROHC in O/R mode.

The operation of the mobile communication system supporting a bidirectional real time communication by adopting the PDCP entity-RLC entity mapping structure according to the first preferred embodiment of the present invention will be described hereinafter in more detail.

It is assumed that the PDCP entity-RLC entity mapping structure of

the first preferred embodiment is implemented in the radio interface protocol architecture of both the transmitter (UE or UTRAN) and receiver (UE or UTRAN).

When a packet is delivered through the RB at the transmitter, the Tx ROHC module of the PDCP entity located in the PDCP layer performs a header compression on the packet and transmits the compressed header packet to the Tx module of BTM/BUM RLC entity through the BTM/BUM SAP. The Tx module of the BTM/BUM RLC entity transfers the compressed header packet to the receiver through the lower layers.

If the receiver receives the compressed header packet, the Rx module of the BTM/BUM RLC entity of the receiver immediately delivers the compressed header packet to the Rx ROHC module of the PDCP entity. The Rx ROHC module of the PDCP entity performs header decompression on the compressed header packet so as to recover and deliver the decompressed header packet to the upper layers.

The PDCP entity of the receiver can report status information to the transmitter such that the PDCP entity of the transmitter determines a compression scheme to be used and whether or not the transmitted packet is successfully received at the receiver on the basis of the status information.

FIG. 7 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a mobile communication system according to a second preferred embodiment of the present invention.

As shown in FIG. 7, one RB is associated with one PDCP entity and the PDCP entity is associated with one real time AM RLC (RAM RLC) entity

through one real time AM SAP (RAM SAP). The RAM RLC entity is associated with the MAC sublayer through two logical channel.

The PDCP entity has a Tx ROHC module for performing header compression on a PDCP SDU received from upper layers and an Rx ROHC module for performing header decompression on PDCP PDUs delivered from lower layers.

The RAM RLC entity includes a Tx module for transferring RLC SDU received from the PDCP entity to a first logical channel and an Rx module for receiving RLC PDUs through a receive side logical channel.

The Tx ROHC module performs header compression upon reception of the PDCP SDU from upper layers and submits the PDCP PDU(s) to Tx module of the RAM RLC entity through the RAM SAP.

On the other hand, when the Rx module of the RAM RLC entity receives RLC PDU through the receive side logical channel, the Rx module of the RAM RLC entity delivers the PDCP PDU (RLC SDU) to the Rx ROHC module of the PDCP entity. The Rx ROHC module performs header decompression upon reception of the PDCU PDU and then delivers the PDCP SDU to the upper layers.

Since one RAM RLC entity is provided with the Tx and Rx modules mapped to respective transmit and receive side logical channels, the RAM RLC entity can support bidirectional communication. To support the bidirectional real time services, it is preferable that the PDCP entity operates the ROHC in O/R mode.

The RAM entity according to the second embodiment of the present invention is similar to the conventional AM RLC entity except that the RAM

RLC entity has no retransmission function. By disabling the retransmission function, the RAM RLC entity can delivers the PDCP PDU to the upper layers without processing delay at the transmitter and receiver.

The operation of the mobile communication system supporting the bidirectional real time communication by adopting the PDCP entity-RLC entity mapping structure according to the second preferred embodiment of the present invention will be described hereinafter in more detail.

It is assumed that the PDCP entity-RLC entity mapping structure of the second preferred embodiment is implemented in the radio interface protocol architecture of both the transmitter (UE or UTRAN) and receiver (UE or UTRAN).

When a packet is delivered through the RB of the transmitter, the Tx ROHC module of the PDCP entity located in the PDCP layer performs a header compression on the packet and transmits the compressed header packet to the Tx module of the RAM RLC entity through the RAM SAP. The Tx module of the RAM RLC entity transfers the compressed header packet to the receiver through the lower layers.

If the receiver receives the compressed header packet, the Rx module of the RAM RLC entity of the receiver immediately delivers the compressed header packet to the Rx ROHC module of the PDCP entity and transmits an acknowledgement to the peer RAM RLC entity of the transmitter at the same time. The Rx ROHC module of the PDCP entity performs header decompression on the compressed header packet so as to recover and deliver the decompressed header packet to the upper layers.

Even though the RAM RLC entity of the receiver transmits the

acknowledgement, the acknowledgement does not contain retransmission related information. That is, when the RLC peer entities operate in RAM, the functions and parameters associated with the packet retransmission such as in sequence delivery, retransmission timers, counters, and transmission and reception windows are disabled. By disabling the retransmission related functions, which mostly causes the processing delay at the RLC layer, is reduced such that it is possible to support real time services.

FIG. 8 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a mobile communication system according to a third preferred embodiment of the present invention.

As shown in FIG. 8, one RB is associated with one PDCP entity and the PDCP entity is associated with a pair of TM or UM (TM/UM) RLC entities, i.e. Tx TM/UM RLC entity and Rx TM/UM RLC entity, through respective TM/UM SAPs. The Tx and Rx TM/UM RLC entities are mapped to respective transmit side and receive side logical channels.

The PDCP entity has a Tx ROHC module for performing header compression on a PDCP SDU received from upper layers and an Rx ROHC module for performing header decompression on PDCP PDU delivered from lower layers.

The Tx ROHC module performs header compression upon reception of the PDCU SDU from upper layers and submits the PDCP PDU(s) to the Tx TM/UM RLC entity through the Tx TM/UM SAP.

On the other hand, when the Rx TM/UM RLC entity receives RLC PDU through the receive side logical channel, the Rx TM/UM RLC entity

delivers the PDCP PDU (RLC SDU) to the Rx ROHC module through the Rx TM/UM SAP. The Rx ROHC module performs header decompression upon reception of the PDCP PDU and then delivers the PDCP SDU to the upper layers.

Since one Tx TM/UM RLC entity and one Rx TM/UM RLC entity are responsible for respective transmitting and receiving RLC PUDs, it is possible to support the bidirectional communication. To support the bidirectional real time services, it is preferable that the PDCP entity operates the ROHC in O/R mode.

In this case, the TM/UM RLC entity operates in the same manner of the conventional TM/UM RLC entity except that the Tx and Rx TM/UM RLC entities simultaneously provides services to one PDCP entity mapped to one RB.

The operation of the mobile communication system supporting the bidirectional real time communication by adopting the PDCP entity-RLC entity mapping structure according to the third preferred embodiment of the present invention will be described hereinafter in more detail.

It is assumed that the PDCP entity-RLC entity mapping structure of the third preferred embodiment is implemented in the radio interface protocol architecture of both the transmitter (UE or UTRAN) and receiver (UE or UTRAN).

When a packet is delivered through the RB of the transmitter, the Tx ROHC module of the PDCP entity located in the PDCP layer performs a header compression on the packet and transmits the compressed header packet to the Tx TM/UM RLC entity through the Tx TM/UM SAP. The Tx

TM/UM RLC entity transfers the compressed header packet to the receiver through the transmit side logical channel.

If the receiver receives the compressed header packet, the Rx TM/UM RLC entity of the receiver immediately delivers the compressed header packet to the Rx ROHC module of the PDCP entity. The Rx ROHC module of the PDCP entity performs header decompression on the compressed header packet so as to recover and deliver the decompressed header packet to the upper layers.

The PDCP entity of the receiver can report status information to the transmitter such that the PDCP entity of the transmitter determines a compression scheme to be used and whether or not the transmitted packet is successfully received at the receiver on the basis of the status information.

FIG. 9 is a block diagram illustrating a PDCP entity-RLC entity-mapping structure for supporting a bidirectional real time communication in a mobile communication system according to a fourth preferred embodiment of the present invention.

As shown in FIG. 9, two RBs are associated with one PDCP entity and the PDCP entity is associated with a pair of TM or UM (TM/UM) RLC entities, i.e. Tx TM/UM RLC entity and Rx TM/UM RLC entity, through respective TM/UM SAPs. The Tx and Rx TM/UM RLC entities are mapped to respective transmit side and receive logical channels.

In this embodiment, the two RBs have unidirectional characteristics and are regarded as transmit RB and receive RB, respectively. However, the present invention is not limited only to this configuration, but, the two RBs can be changed so as to have bidirectional characteristics together with the

modification of the other parts cooperating therewith.

The PDCP entity has a Tx ROHC module for performing header compression on a PDCP SDU received from upper layers and an Rx ROHC module for performing header decompression on PDCP PDU delivered from lower layers.

The Tx ROHC module performs header compression upon reception of PDCP SDU form upper layers through the transmit side RB and submits the PDCP PDU to the Tx TM/UM RLC entity through the Tx TM/UM SAP.

On the other hand, when the Rx TM/UM RLC entity receives RLC PDU through the receive side logical channel, the Rx TM/UM RLC entity delivers the PDCP PDU (RLC SDU) to the Rx ROHC module through the Rx TM/UM SAP. The Rx ROHC module performs header decompression upon reception of the PDCP PDU and then delivers the PDCP SDU to the upper layers through the receive side RB.

Since one Tx TM/UM RLC entity and one Rx TM/UM RLC entity are responsible for respective transmitting and receiving RLC PDUs, it is possible to support the bidirectional communication. To support the bidirectional real time services, it is preferable that the PDCP entity operates in the ROHC in O/R mode.

Similar to the third preferred embodiment, the Tx and Rx TM/UM RLC entities simultaneously provides services to the one PDCP. However, in the fourth embodiment the Tx ROHC module of the PDCP entity is mapped to the transmit side RB and the Rx ROHC module of the PDCP entity is mapped to the receive side RB.

The operation of the mobile communication system supporting the

bidirectional real time communication by adopting the PDCP entity-RLC entity-mapping structure according to the fourth preferred embodiment of the present invention will be described hereinafter in more detail.

It is assumed that the PDCP entity-RLC entity mapping structure of the fourth preferred embodiment is implemented in the radio interface protocol architecture of both the transmitter (UE or UTRAN) and receiver (UE or UTRAN).

When a packet is delivered through the transmit side RB at the transmitter, the Tx ROHC module of the PDCP entity located in the PDCP layer performs header compression on the packet and transmits the compressed header packet to the Tx TM/UM RLC entity through the Tx TM/UM SAP. The Tx TM/UM RLC entity transfers the compressed header packet to the receiver through the transmit side logical channel.

If the receiver receives the compressed header packet, the Rx TM/UM RLC entity of the receiver immediately delivers the compressed header packet to the Rx ROHC module of the PDCP entity. The Rx ROHC module of the PDCP entity performs header decompression on the compressed header packet so as to deliver the decompressed header packet to the upper layers through the receive side RB.

The PDCP entity of the receiver can report status information to the transmitter such that the PDCP entity of the transmitter determines a compression scheme to be used and whether or not the transmitted packet is successfully received at the receiver on the basis of the status information.

As described above, in one aspect of the PDCP entity-to-RLC entity mapping structure according to the mobile communication method and

system of the present invention, since each of the PDCP peer entities at the transmitter and receiver has a transmit side ROHC and receive side ROHC modules operating in O/R mode and is mapped one RLC entity which can simultaneously activate a pair of transmit and receive modules mapped to different logical channels in transparent mode (TM) or unacknowledged mode (UM), the PDCP entity can support bidirectional real time services to the upper layers even in the transparent mode or unacknowledged mode.

In another aspect of the PDCP entity-to-RLC entity mapping structure according to the mobile communication method and system of the present invention, since each of the PDCP peer entities at the transmitter and receiver has a transmit side ROHC and receiver side ROHC modules operating in O/R mode and is mapped one RLC entity which disables the retransmission function in the acknowledgement mode (AM), the PDCP entity can support bidirectional real time service to the upper layers even in acknowledged mode.

In another aspect of the PDCP entity-to-RLC entity mapping structure according to the mobile communication method and system of the present invention, since each of the PDCP peer entities at the transmitter and receiver has a transmit side ROHC and receiver side ROHC modules operating in O/R mode and is mapped to two RLC entities responsible for packet transmission and reception, respectively, in the transparent mode or unacknowledged mode, the PDCP entity can support bidirectional real time service to the upper layer even in the transparent mode or unacknowledged mode.

In still another aspect of the PDCP entity-to-RLC entity mapping

structure according to the mobile communication method and system of the present invention, since each of the PDCP peer entities at the transmitter and receiver is associated two radio bearers, one for transmit side and the other for receive side, and mapped to two RLC entities responsible for packet transmission and reception, respectively, in the transparent mode or unacknowledged mode, the PDCP entity can support bidirectional real time service to the upper layer even in the transparent mode or unacknowledged mode.

In the present invention, since one or two RLC entities are responsible for bidirectional two way communication, it is possible to support bidirectional real time services in packet-switched domain as well as circuit-switched domain.

While this invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments, but, on the contrary, is intended to cover various modification and equivalent arrangements included within the spirit and scope of the appended claims.

What Is Claimed Is:

1. A method for wireless communication between a terminal and a base station operating in at least two packet switching-based data transfer modes, comprising:

communicating packet bidirectionally between the terminal and the base station in real time in all of the data transfer modes.

2. The method of claim 1, wherein communicating packets includes:

establishing a communication channel between the terminal and the base station; and

transmitting, receiving, or simultaneously transmitting and receiving the packet through the communication channel..

3. The method of claim 2, wherein establishing the communication channel includes:

configuring a first entity which converges the packet associated with at least one radio bearer;

configuring at least one second entity which provides packet transfer services to the first entity; and

mapping the second entity to two logical channels.

4. The method of claim 3, wherein the first entity is provided with a header compression function.

5. The method of claim 4, wherein the header compression function activates a header compressor and/or a header decompressor according to characteristics of the radio bearer.

6. The method of claim 5, wherein the header compressor performs header compression upon reception of the packet from upper layers through the radio bearer so as to generate a compressed header packet.

7. The method of claim 5, wherein the header decompressor performs header decompression upon reception of a compressed header packet from the second entity.

8. The method of claim 5, wherein the header compressor performs header compression upon reception of the packet from upper layers through the radio bearer and the header decompressor performs header decompression upon reception of a compressed header packet from the second entity.

9. The method of claim 8, wherein the first entity is mapped with one radio bearer which has a bidirectional characteristic.

10. The method of claim 9, wherein the first entity is mapped to one second entity.

11. The method of claim 10, wherein the second entity has a transmit

side module which transmits the compressed header packet from the first entity through one of the logical channels and a receive side module which receives the packet from the lower layer through the other of the logical channels.

12. The method of claim 11, wherein the header compressor is mapped to the transmit side module through a service access point.

13. The method of claim 11, wherein the header decompressor is mapped to the receive side module through a service access point.

14. The method of claim 11, wherein the header compressor is mapped to the transmit side module through a service access point and the header decompressor is mapped to the receive side module through the service access point.

15. The method of claim 14, wherein the second entity supports packet loss sensitive services that does not permit packet loss.

16. The method of claim 15, wherein the second entity disables a packet retransmission function thereof.

17. The method of claim 9, wherein the first entity is mapped to two second entities.

18. The method of claim 17, wherein one of the two second entities is responsible for transmission of the packet through one of the two logical channels.

19. The method of claim 17, wherein one of the two second entities is responsible for reception of the packet through one of the two logical channels.

20. The method of claim 17, wherein one of the two second entities is responsible for transmission of the packet received from the first entity through one of the two logical channels and the other is responsible for reception of the packet through the other logical channel.

21. The method of claim 20, wherein the header compressor is mapped to the second entity responsible for transmission of the packet through a service access point.

22. The method of claim 20, wherein the header decompressor is mapped to the second entity responsible for reception of the packet through a service access point.

23. The method of claim 20, wherein the header compressor and header decompressor are mapped to different second entities through different service access points, the second entities being respectively responsible for transmission and reception of the packet.

24. The method of claim 8, wherein the first entity is mapped with two radio bearers of which each has a unidirectional characteristic.

25. The method of claim 24, wherein the first entity is mapped to two second entities.

26. The method of claim 24, wherein one of the two second entities is responsible for transmission of the packet through one of the two logical channels.

27. The method of claim 24, wherein one of the two second entities is responsible for reception of the packet through one of the two logical channels.

28. The method of claim 24, wherein one of the two second entities is responsible for transmission of the packet through one of the two logical channels and the other is responsible for reception of the packet through the other logical channel.

29. The method of claim 28, wherein the header compressor is mapped to the second entity responsible for transmission of the packet through a service access point.

30. The method of claim 28, wherein the header decompressor is

mapped to the second entity responsible for reception of the packet through a service access point.

31. The method of claim 28, wherein the header compressor and header decompressor are mapped to different second entities through different service access points, the second entities being respectively responsible for transmission and reception of the packet.

32. A method for wireless communication between a terminal and a base station supporting a real time packet transfer service mode and reliable packet transfer service mode, comprising:

selecting one of the real time packet transfer service mode and reliable packet transfer service mode;

establishing a communication channel between the terminal and the base station; and

transmitting, receiving, or simultaneously transmitting and receiving packet data in real time.

33. The method of claim 32, wherein establishing the communication channel includes:

configuring a packet data convergence protocol (PDCP) entity located in a PDCP layer, the PDCP entity being associated with at least one radio bearer;

configuring at least one radio link control (RLC) entity located in an RLC layer; and

mapping the RLC entity to two logical channels.

34. The method of claim 33, wherein the PDCP entity is provided with a header compression function.

35. The method of claim 34, wherein the header compression function enables a header compressor and header decompressor according to characteristics of the radio bearer.

36. The method of claim 35, wherein the header compressor performs header compression upon reception of the packet data from upper layers through the radio bearer so as to generate a compressed header packet and the header decompressor performs header decompression upon reception of a compressed header packet from the RLC entity.

37. The method of claim 36, wherein the PDCP entity is mapped to one RLC entity.

38. The method of claim 37, wherein the RLC entity has a transmit side module which transmits the compressed header packet from the PDCP entity through one of the logical channels and a receive side module which receives the packet from the lower layer through the other of the logical channels.

39. The method of claim 38, wherein the header compressor is

mapped to the transmit side module through a service access point and the header decompressor is mapped to the receive side module through the service access point.

40. The method of claim 39, wherein the RLC entity disables a packet retransmission function.

41. The method of claim 36, wherein the PDCP entity is mapped to two RLC entities.

42. The method of claim 41, wherein the PDCP entity is associated with one radio bearer.

43. The method of claim 42, wherein one of the two RLC entities is responsible for transmission of the packet from the PDCP entity through one of the two logical channels and the other is responsible for reception of the packet through the other logical channel.

44. The method of claim 43, wherein the header compressor and header decompressor are mapped to different RLC entities through different service access points, the RLC entities being respectively responsible for transmission and reception of the packet.

45. The method of claim 41, wherein the PDCP entity is associated with two radio bearers of which each has a unidirectional characteristic.

46. The method of claim 45, wherein the PDCP entity is mapped to two RLC entities.

47. The method of claim 46, wherein one of the two RLC entities is responsible for transmission of the packet through one of the two logical channels and the other is responsible for reception of the packet through the other logical channel.

48. The method of claim 47, wherein the header compressor and header decompressor are mapped to different RLC entities through different service access points, the RLC entities being respectively responsible for transmission and reception of the packet.

49. A wireless communication system having at least one communication channel between a terminal and a base station, each of the terminal and base station comprising:

a mode selector which selects one of a real time packet transfer service mode and a reliable packet transfer service mode according to characteristics of a service to be provided to upper layers; and

a channel configuring unit which configures the communication channel between the terminal and the base station based on the service mode selected by the mode selector,

wherein the channel configuring unit configures the channel such that the terminal and the base station bidirectionally exchange packets in both the

real time packet transfer service mode and a reliable packet transfer service mode..

50. A wireless communication system having at least one communication channel between a terminal and a base station operating with layered radio interface protocol architecture, each of the terminal and base station comprising:

a mode selector which select one of packet transfer modes provided by a radio link control layer according to characteristics of radio bearers to be provided to upper layers; and

a channel configuring unit which configures the communication channel between the terminal and the base station based on the packet transfer mode selected by the mode selector,

wherein the channel configuring unit activates a first entity positioned in a packet data convergence protocol layer, the first entity being associated with one or two radio bearers, activates one or two second entities positioned in a radio link control layer, the one or two second entities being mapped to two logical channels, and maps the first entity to one or two second entities.

51. The system of claim 50, wherein the first entity is provided with a header compression function.

52. The system of claim 51, wherein the header compression function enables a header compressor and header decompressor according to characteristics of the radio bearer.

53. The system of claim 52, wherein the header compressor performs header compression upon reception of a packet from the upper layers through the radio bearer so as to generate a compressed header packet and the header decompressor performs header decompression upon reception of a compressed header packet from the second entity.

54. The system of claim 53, wherein the first entity is mapped to one second entity.

55. The system of claim 54, wherein the second entity has a transmit side module which transmits the compressed packet from the first entity through one of the logical channels and a receive side module which receives the packet from the lower layer through the other of the logical channels.

56. The system of claim 55, wherein the header compressor is mapped to the transmit side module through a service access point and the header decompressor is mapped to the receive side module through the service access point.

57. The system of claim 53, wherein the first entity is mapped to two second entities.

58. The system of claim 57, wherein the first entity is associated with

one radio bearer.

59. The system of claim 58, wherein one of the two second entities is responsible for transmission of the packet received from the first entity through one or the two logical channels and the other is responsible for reception of the packet through the other logical channel.

60. The system of claim 59, wherein the header compressor and header decompressor are mapped to different second entities through different service access points, the second entities being respectively responsible for transmission and reception of the packet.

61. The system of claim 57, wherein the first entity is associated with two radio bearers of which each has a unidirectional characteristic.

62. The system of claim 61, wherein the first entity is mapped to two RLC entities.

63. The system of claim 62, wherein one of the two second entities is responsible for transmission of the packet through one of the two logical channels and the other is responsible for reception of the packet through the other logical channel.

64. The system of claim 63, wherein the header compressor and header decompressor are mapped to different second entities through

different service access points, the second entities being respectively responsible for transmission and reception of the packet.

65. A method for wireless communication between two transceivers operating with radio interface protocol architecture, comprising:

configuring a first entity which is associated with one radio bearer and converges packets at each of the transceivers;

configuring a second entity which provides bidirectional packet transfer service to the first entity through a service access point without retransmission function; and

mapping the second entity to a pair of transmitting side and receiving side logical channels.

66. The method of claim 65, wherein the radio bearer has bidirectional characteristic.

67. The method of claim 65, wherein the first entity has a header compressor and a header decompressor.

68. The method of claim 65, wherein the second entity has a transmitting side module and a receiving side module mapped to the respective transmitting and receiving side logical channels.

69. The method of claim 66, wherein the first entity has a header compressor and a header decompressor and the second entity has a

transmitting side module mapped to the header compressor and a receiving side module mapped to the header decompressor.

70. The method of claim 69, wherein the transmitting side module is mapped to the transmitting side logical channel and the receiving side module is mapped to the receiving side logical channel.

71. The method of claim 70, wherein the header compressor performs header compression upon reception of the packet from upper layers through the radio bearer so as to generate a compressed header packet and the header decompressor performs header decompression upon reception of a compressed header packet from the second entity.

72. The method of claim 65, wherein the first entity is a packet data convergence protocol (PDCP) entity located in a PDCP layer and the second entity is a radio link control (RLC) entity located in an RLC layer and operating an acknowledged mode (AM).

73. The method of claim 72, wherein the radio bearer has a bidirectional characteristic.

74. The method of claim 73, wherein the PDCP entity has a header compression and decompression function.

75. The method of claim 74, wherein the PDCP entity performs

header compression upon reception of the packet from upper layers through the radio bearer so as to generate a compressed header packet and submit the compressed header packet to the RLC entity.

76. The method of claim 75, wherein the PDCP entity performs header decompression upon reception of the compressed header packet from the RLC entity and delivers the packet to the upper layers.

77. The method of claim 76, the RLC entity transmits the compressed header packet through the transmitting side logical channel and receives the compressed header packet through the receiving side logical channel without retransmission procedure.

78. A method for wireless communication between two transceivers operating with radio interface protocol architecture, comprising:

configuring a first entity which is associated with one radio bearer and converges packets at each of the transceivers;

configuring at least one second entity which provides real time packet transfer service to the first entity;

mapping the second entity to a pair of transmitting side and receiving side logical channels.

79. The method of claim 78, wherein the radio bearer has bidirectional characteristic.

80. The method of claim 79, wherein the first entity has a header compressor and a header decompressor.

81. The method of claim 80, wherein the first entity is mapped to one second entity.

82. The method of claim 81, wherein the second entity has a transmitting side module and a receiving side module mapped to the respective transmitting and receiving side logical channels.

83. The method of claim 82, wherein the header compressor and the header decompressor are mapped to the respective transmitting and receiving side modules.

84. The method of claim 83, wherein the header compressor performs header compression upon reception of the packet from upper layers through the radio bearer so as to generate a compressed header packet and the header decompressor performs header decompression upon reception of a compressed header packet from the second entity and delivers the packet to the upper layers through the radio bearer.

85. The method of claim 80, wherein the first entity is mapped to two second entities.

86. The method of claim 85, wherein the two second entities provide

real time packet transfer service to the first entity through respective service access points.

87. The method of claim 86, wherein two second entities are a transmitting side second entity which transmits the packet from the first entity through the transmitting side logical channel and a receiving side second entity which receives packet through the receiving side logical channel and deliver the packet to the first entity.

88. The method of claim 87, wherein the header compressor and the header decompressor are mapped to the respective transmitting side second entity and receiving side second entity.

89. The method of claim 88, wherein the header compressor performs header compression upon reception of the packet from upper layers through the radio bearer so as to generate and transmit a compressed header packet to the transmitting side second entity through a transmitting side service access point, and the header decompressor performs header decompression upon reception of a compressed header packet from the receiving side second entity through a receiving side service access point and delivers the packet to the upper layers through the radio bearer.

90. The method of claim 81, wherein the first entity is a packet data convergence protocol (PDCP) entity located in a PDCP layer and the second entity is a radio link control (RLC) entity located in an RLC layer and

operating a transparent mode or unacknowledged mode (TM/UM).

91. The method of claim 90, wherein the RLC entity has a transmitting side module and a receiving side module mapped to the respective transmitting and receiving side logical channels.

92. The method of claim 91, wherein the header compressor performs header compression upon reception of the packet from upper layers through the radio bearer so as to generate a compressed header packet and submit the compressed header packet to a transmitting side module of the RLC entity.

93. The method of claim 92, wherein the header decompressor performs header decompression upon reception of the compressed header packet from a receiving side module of the RLC entity and delivers the packet to the upper layers.

94. The method of claim 93, wherein the transmitting side module transmits the compressed header packet through the transmitting side logical channel and the receiving side module receives the compressed header packet through the receiving side logical channel at the same time.

95. The method of claim 85, wherein the first entity is a packet data convergence protocol (PDCP) entity located in a PDCP layer and the second entity is a radio link control (RLC) entity located in an RLC layer and

operating a transparent mode or unacknowledged mode (TM/UM).

96. The method of claim 95, wherein the two RLC entities provide real time packet transfer service to the first entity through respective service access points.

97. The method of claim 96, wherein the two RLC entities are a transmitting side RLC entity which transmits the packet from the PDCP entity through the transmitting side logical channel and a receiving side RLC entity which receives packet through the receiving side logical channel and deliver the packet to the PDCP entity.

98. The method of claim 97, wherein the header compressor and the header decompressor are mapped to the respective transmitting side RLC entity and receiving side RLC entity.

99. The method of claim 97, wherein the header compressor performs header compression upon reception of the packet from upper layers through the radio bearer so as to generate and transmit a compressed header packet to the transmitting side RLC entity through a transmitting side service access point, and the header decompressor performs header decompression upon reception of a compressed header packet from the receiving side RLC entity through a receiving side service access point and delivers the packet to the upper layers through the radio bearer.

100. A method for wireless communication between two transceivers operating with radio interface protocol architecture, comprising:

configuring a first entity which is associated with two radio bearers and converges packets at each of the transceivers;

configuring at least one second entity which provides real time packet transfer service to the first entity through at least one service access point; and

mapping the second entity to a pair of transmitting side and receiving side logical channels.

101. The method of claim 100, wherein each of the radio bearers has a unidirectional characteristic.

102. The method of claim 101, wherein the radio bearers are a transmitting service radio bearer and a receiving service radio bearer.

103. The method of claim 102, wherein the first entity has a header compressor and a header decompressor.

104. The method of claim 103, wherein the header compressor is associated with the transmitting service radio bearer and the header decompressor is associated with the receiving service radio bearer.

105. The method of claim 104, wherein the first entity is mapped to one second entity which has a transmitting side module and a receiving side

module mapped to the respective transmitting and receiving side logical channels.

106. The method of claim 105, wherein the header compressor and the header decompressor are mapped to the respective transmitting and receiving side modules.

107. The method of claim 106, wherein the header compressor performs header compression upon reception of the packet from upper layers through the transmitting service radio bearer so as to generate and transfer a compressed header packet to the transmitting side module, and the header decompressor performs header decompression upon reception of a compressed header packet from the receiving side module and delivers the packet to the upper layer through the receiving service radio bearer.

108. The method of claim 104, wherein the first entity is mapped to two second entities.

109. The method of claim 108, wherein the two second entities provides real time packet transfer service to the first entity through respective service access points.

110. The method of claim 109, wherein two second entities are a transmitting side second entity which transmits the packet from the first entity to the transmitting side logical channel and a receiving side second entity

receives the packet through the receiving side logical channel and delivers the packet to the first entity.

111. The method of claim 110, wherein the header compressor and the header decompressor are mapped to the respective transmitting side second entity and receiving side second entity.

112. The method of claim 111, wherein the header compressor performs header compression upon reception of the packet from upper layers through the transmitting service radio bearer so as to generate and transmit a compressed header packet to the transmitting side second entity through a transmitting side service access point, and the header decompressor performs header decompression upon reception of a compressed header packet from the receiving side second entity through a receiving side service access point and delivers the packet to the upper layer through the receiving service radio bearer.

113. The method of claim 104, wherein the first entity is a packet data convergence protocol (PDCP) entity located in a PDCP layer and the second entity is a radio link control (RLC) entity located in an RLC layer and operation a transparent mode or unacknowledged mode (TM/UM).

114. The method of claim 113, wherein the PDCP entity has a header compression and decompression function.

115. The method of claim 114, wherein the PDCP entity performs header compression upon reception of the packet from upper layers through a transmitting service radio bearer so as to generate a compressed header packet and submit the compressed header packet to a transmitting side module of one RLC entity.

116. The method of claim 115, wherein the PDCP entity performs header decompression upon reception of the compressed header packet from a receiving side module of the RLC entity and delivers the packet to the upper layers through a receiving service radio bearer.

117. The method of claim 116, wherein the transmitting side module transmits the compressed header packet through the transmitting side logical channel and the receiving side module receives the compressed header packet through the receiving side logical channel at the same time.

118. The method of claim 114, wherein the PDCP entity performs header compression upon reception of the packet from upper layers through the transmitting service radio bearer radio bearer so as to generate a compressed header packet and submit the compressed header packet to a transmitting side RLC entity.

119. The method of claim 118, wherein the PDCP entity performs header decompression upon reception of the compressed header packet from a receiving side RLC entity and delivers the uncompressed header

packet to the upper layers through the receiving service radio bearer.

120. A method for wireless communication between two transceivers operating with radio interface protocol architecture, comprising:

configuring a packet data convergence protocol (PDCP) entity in a PDCP layer, the PDCP entity being associated with two radio bearers;

configuring two radio link control (RLC) entities in an RLC layer, the RLC entities providing packet transfer services to the PDCP entity in a transparent mode or unacknowledged mode (TM/UM); and

mapping the RLC entities to respective transmitting and receiving side logical channels.

121. The method of claim 120, wherein the radio bearers are a transmitting service radio bearer and a receiving service radio bearer having unidirectional characteristic.

122. The method of claim 121, wherein the PDCP entity has a header compressor and a header decompressor.

123. The method of claim 122, wherein the header compressor is mapped to the transmitting service radio bearer and the header decompressor is mapped to the receiving service radio bearer.

124. The method of claim 123, wherein the RLC entities are a transmitting side RLC entity and a receiving side RLC entity.

125. The method of claim 124, wherein the transmitting side RLC entity is mapped to the header compressor and the receiving side RLC entity is mapped to the header decompressor.

126. The method of claim 125, wherein the header compressor performs header compression upon reception of the packet from upper layers through the transmitting service radio bearer so as to generate and transmit a compressed header packet to the transmitting side RLC entity through a transmitting side service access point, and the header decompressor performs header decompression upon reception of a compressed header packet from the receiving side RLC entity through a receiving side service access point and delivers the packet to the upper layers thourhg the receiving service radio bearer.

127. A method for wireless communication between two transceivers operating with radio interface protocol architecture, comprising:

configuring two packet data convergence protocol (PDCP) entities in a PDCP layer, the PDCP entities are associated with respective radio bearers;

configuring a radio link control (RLC) entity in a RLC layer, the RLC entity providing packet transfer services to the PDCP entities in a transparent mode or unacknowledged mode (TM/UM); and

mapping the RLC entity to a pair of transmitting and receiving side logical channels.

128. The method of claim 127, wherein the radio bearers are a transmitting service radio bearer and a receiving service radio bearer having unidirectional characteristic.

129. The method of claim 128, wherein the PDCP entities are a transmitting side PDCP entity having a header compressor and a receiving side PDCP entity having a header decompressor.

130. The method of claim 129, wherein the RLC entity has a transmitting module responsible for transmitting the packet and a receiving module responsible for receiving the packet.

131. The method of claim 130, wherein the transmitting module is mapped to the header compressor and the receiving module is mapped to the header decompressor.

132. The method of claim 131, wherein the header compressor performs header compression upon reception of the packet from upper layers through the transmitting service radio bearer so as to generate and transmit a compressed header packet to the transmitting module of the RLC entity, and the header decompressor performs header decompression upon reception of a compressed header packet from the receiving module of the RLC entity and delivers the packet to the upper layers through the receiving service radio bearer.

133. An apparatus comprising:

a wireless transmitter, wherein the wireless transmitter is a substantially non-delaying wireless transmitter;

a wireless receiver, wherein the wireless receiver is a substantially non-delaying wireless receiver; and

a data processor, wherein:

the data processor is configured to transmit data to the wireless transmitter;

the data processor is configured to receive data from the wireless receiver; and

the data processor is configured to utilize data received from the wireless receiver as feedback for processing data to be transmitted to the wireless transmitter.

134. The apparatus of claim 133, wherein the apparatus is a first wireless device.

135. The apparatus of claim 134, wherein the data received from the wireless receiver utilized as feedback comprises feedback information transmitted from a second wireless device.

136. The apparatus of claim 135, wherein the communication between the first wireless device and the second wireless device is peer-to-peer communication.

137. The apparatus of claim 133, wherein the substantially non-delaying wireless transmitter operates in real time.

138. The apparatus of claim 133, wherein the substantially non-delaying wireless receiver operates in real time.

139. The apparatus of claim 133, wherein the apparatus is comprised in a mobile station.

140. The apparatus of claim 139, wherein the mobile station is user equipment.

141. The apparatus of claim 140, wherein the user equipment is UE.

142. The apparatus of claim 133, wherein the apparatus is comprised in a base station.

143. The apparatus of claim 142, wherein the base station is a universal mobile telecommunications system terrestrial radio access network.

144. The apparatus of claim 143, wherein the universal mobile telecommunications system terrestrial radio access network is UTRAN.

145. The apparatus of claim 133, wherein the wireless transmitter is

comprised in a transmission module.

146. The apparatus of claim 145, wherein the transmission module is a Tx module.

147. The apparatus of claim 133, wherein the wireless receiver is comprised in a reception module.

148. The apparatus of claim 147, wherein the reception module is a Rx module.

149. The apparatus of claim 133, wherein the wireless transmitter and the wireless receiver are comprised in the same entity.

150. The apparatus of claim 149, wherein the wireless transmitter and the wireless receiver are comprised in the same entity, and wherein the entity is a transparent mode entity.

151. The apparatus of claim 150, wherein the transparent mode entity is a bidirectional transparent mode radio link control entity.

152. The apparatus of claim 151, wherein the bidirectional transparent mode radio link control entity is a BTM entity

153. The apparatus of claim 149, wherein the wireless transmitter and

the wireless receiver are comprised in the same entity, wherein the entity is a unacknowledged mode radio link control entity.

154. The apparatus of claim 153, wherein the unacknowledged mode entity is a bidirectional unacknowledged mode radio link control entity.

155. The apparatus of claim 154, wherein the bidirectional unacknowledged mode radio link control entity is a BUM entity.

156. The apparatus of claim 149, wherein the wireless transmitter and the wireless receiver are comprised in the same entity, and wherein the entity is an acknowledged mode entity.

157. The apparatus of claim 156, wherein the acknowledged mode entity is a real time acknowledged mode radio link control entity.

158. The apparatus of claim 157, wherein the real time acknowledged mode radio link control entity is a RAM RLC entity.

159. The apparatus of claim 133, wherein:

the wireless transmitter is comprised in a first entity; and

the wireless receiver is comprised in a second entity.

160. The apparatus of claim 159, wherein the first entity and the second entity are separate.

161. The apparatus of claim 160, wherein the first entity is a transmission transparent mode radio link control entity.

162. The apparatus of claim 161, wherein the transmission transparent mode radio link control entity is a Tx TM RLC entity.

163. The apparatus of claim 160, wherein the second entity is a reception transparent mode radio link control entity.

164. The apparatus of claim 163, wherein the reception transparent mode radio link control entity is a Rx TM RLC entity.

165. The apparatus of claim 160, wherein the first entity is a transmission unacknowledged mode radio link control entity.

166. The apparatus of claim 165, wherein the transmission unacknowledged mode radio link control entity is a Tx UM RLC entity.

167. The apparatus of claim 160, wherein the second entity is a reception unacknowledged mode radio link control entity.

168. The apparatus of claim 167, wherein the reception unacknowledged mode radio link control entity is a Rx UM RLC entity.

169. The apparatus of claim 133, wherein the data processor is a digital data processor.

170. The apparatus of claim 169, wherein the digital data processor is a packet processor.

171. The apparatus of claim 170, wherein the packet processor is a packet data processor.

172. The apparatus of claim 171, wherein the packet processor is configured to transmit packets to the wireless transmitter.

173. The apparatus of claim 172, wherein the packet processor comprises a transmission robust header compression entity.

174. The apparatus of claim 173, wherein the transmission robust header compression entity is a Tx ROHC entity.

175. The apparatus of claim 173, wherein the packet processor comprises a packet receiver configured to receive packets from the wireless receiver.

176. The apparatus of claim 175, wherein the packet receiver is configured to provide feedback to the packet transmitter.

177. The apparatus of claim 175, wherein the feedback is utilized by the packet transmitter to optimize packet compression.

178. The apparatus of claim 177, wherein the packet receiver comprises a reception robust header compression entity.

179. The apparatus of claim 178, wherein the reception robust header compression entity is a Rx ROHC entity.

180. The apparatus of claim 170, wherein the packet processor is a packet data converge protocol entity.

181. The apparatus of claim 180, wherein the packet data converge protocol entity is a PDCP entity.

182. A method comprising:

transmitting data from a data processor to a wireless transmitter;

receiving data at the data processor from a wireless receiver; and

utilizing received data at the data processor as feedback for configuring a protocol for said transmitting data from the data processor to the wireless transmitter, wherein:

the wireless transmitter is substantially non-delaying; and

the wireless receiver is substantially non-delaying.

183. A system comprising:

a first wireless device;

a second wireless device; and

a means for substantially undelayed bidirectional communication between the first wireless device and the second wireless device.

184. A method comprising configuring a single radio information transmission path in a single wireless device by at least two wireless entities, wherein each of said at least two wireless entities comprise at least one of:

a wireless transmitter; and

a wireless receiver.

185. The method of claim 184, wherein the single radio information transmission path is a single radio bearer.

186. The method of claim 184, wherein said at least two wireless transmitters are at least two radio link control entities.

FIG. 1
BACKGROUND ART

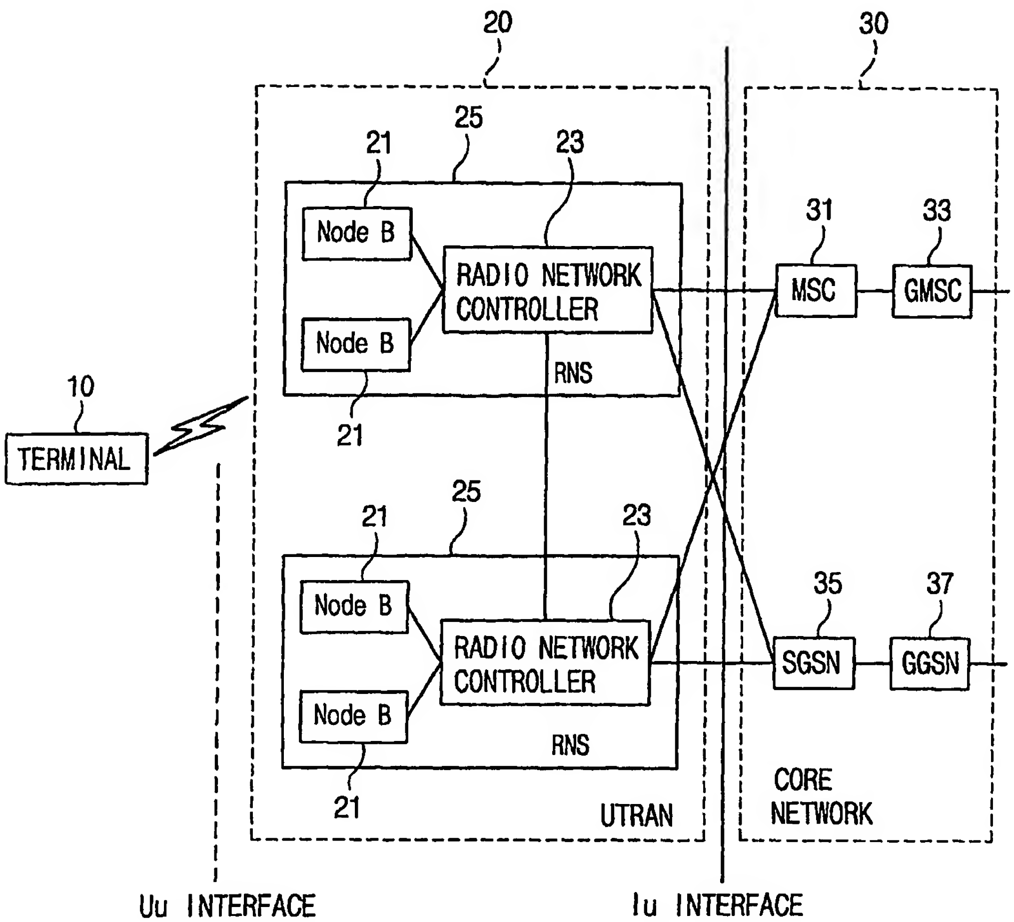
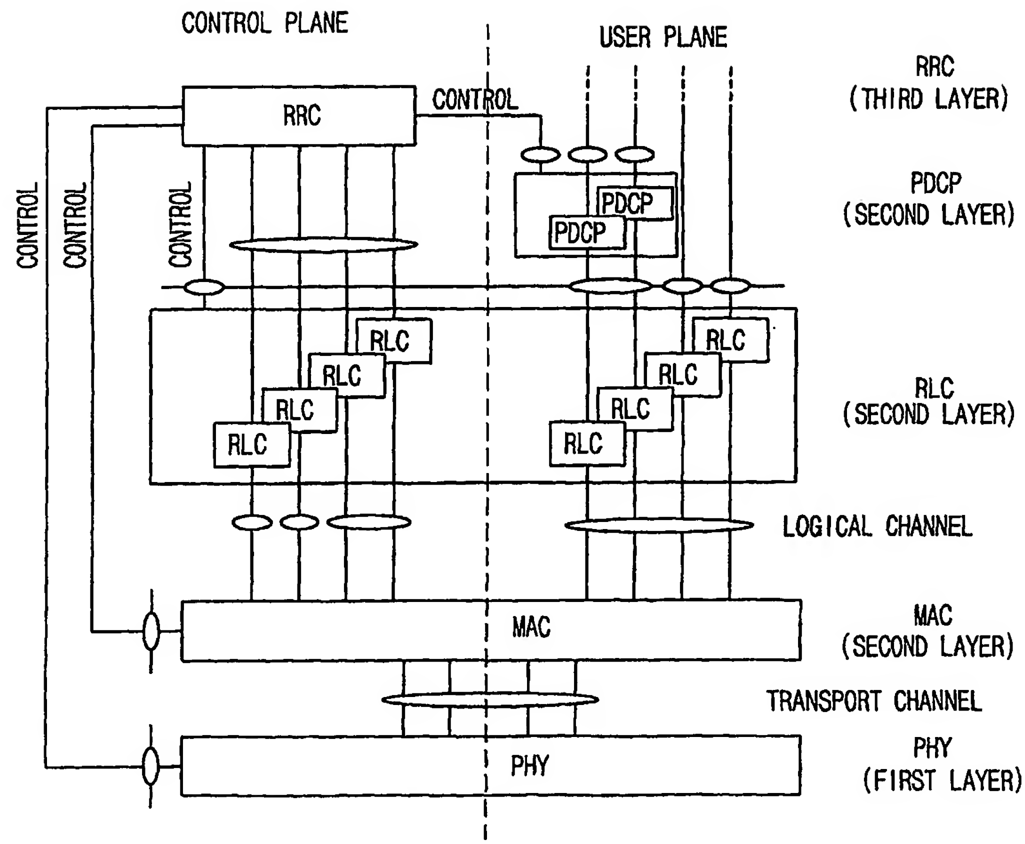


FIG. 2
BACKGROUND ART



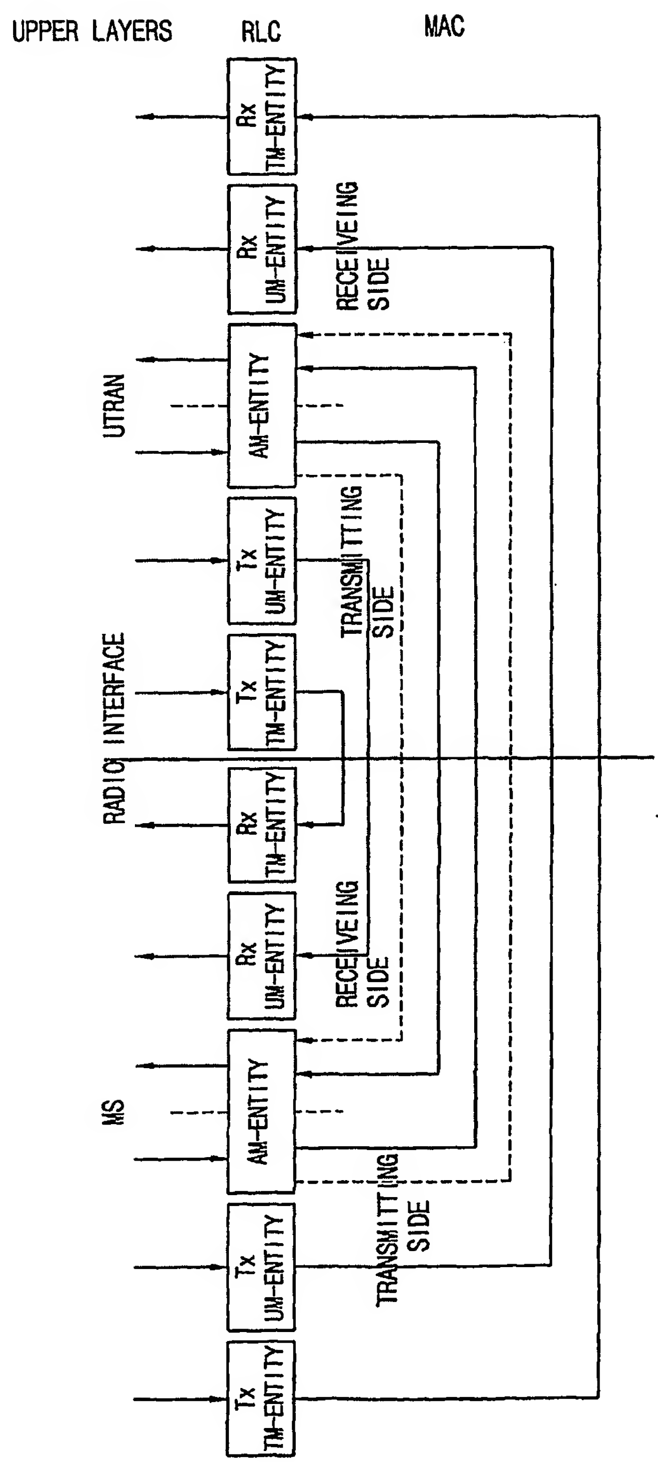


FIG. 3
BACKGROUND ART

FIG. 4
BACKGROUND ART

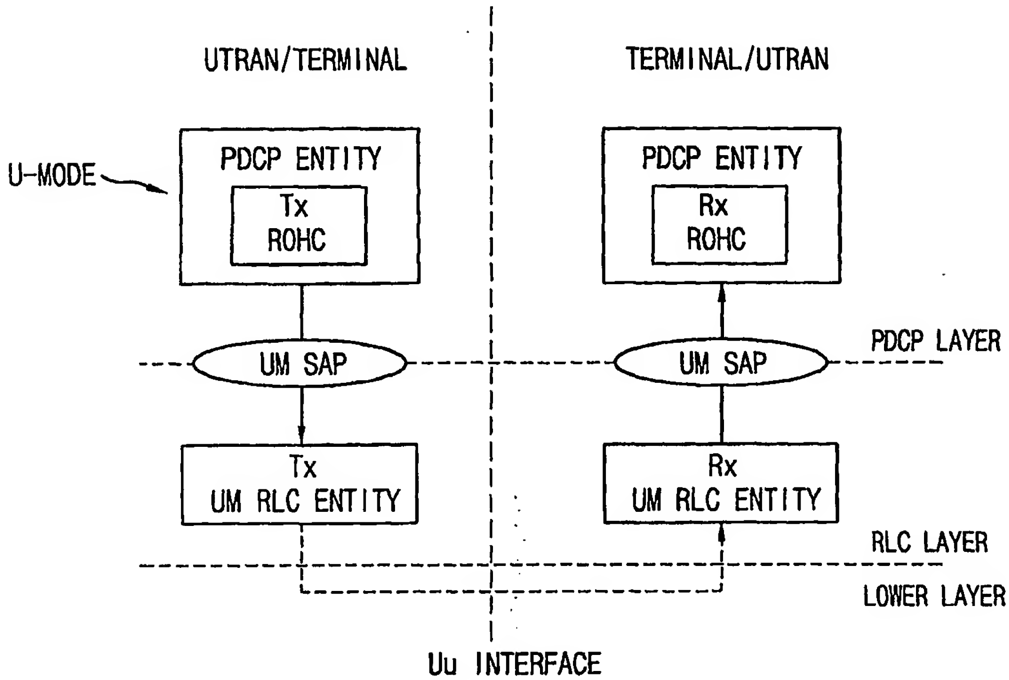


FIG. 5
BACKGROUND ART

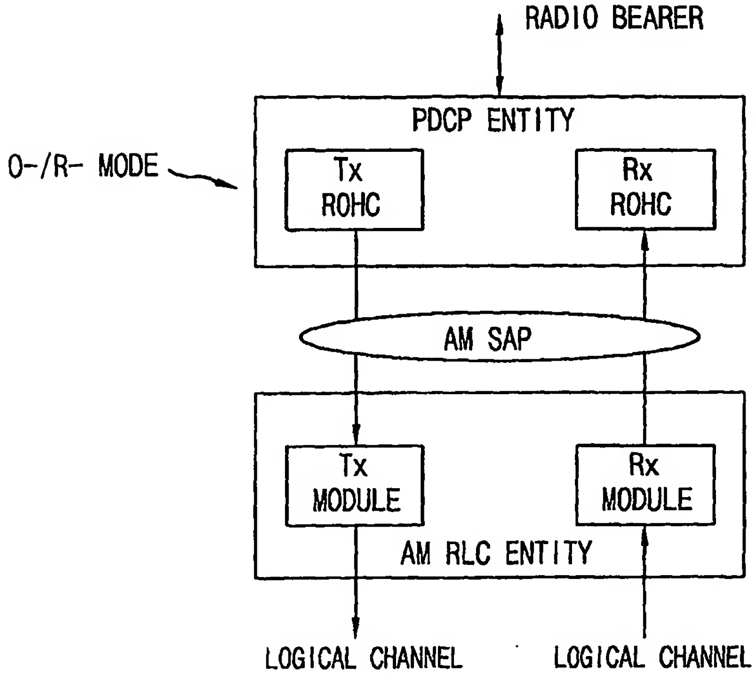


FIG. 6

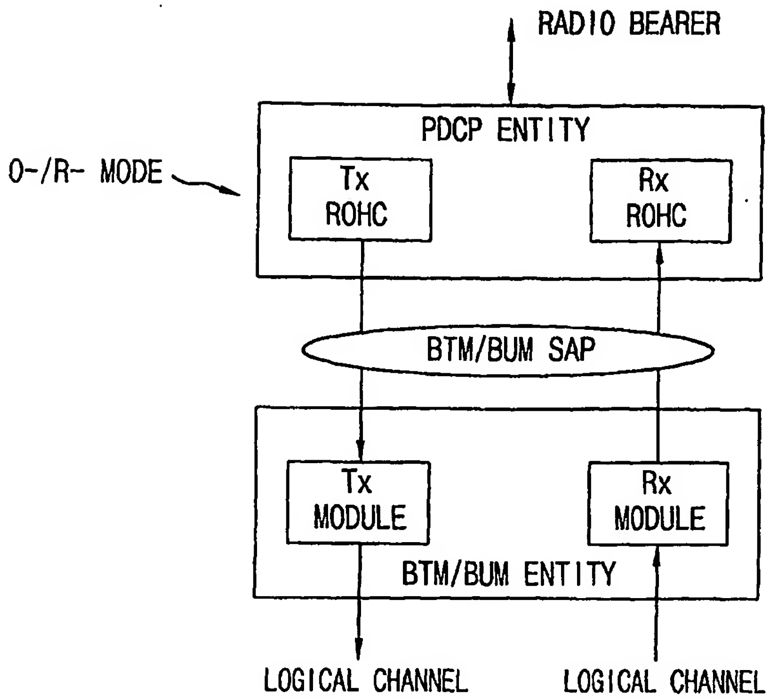

RADIO BEARER
PDCP ENTITY
O-/R- MODE
Tx
ROHC
Rx
ROHC
BTM/BUM SAP
Tx
MODULE
Rx
MODULE
BTM/BUM ENTITY
LOGICAL CHANNEL
LOGICAL CHANNEL

FIG. 7

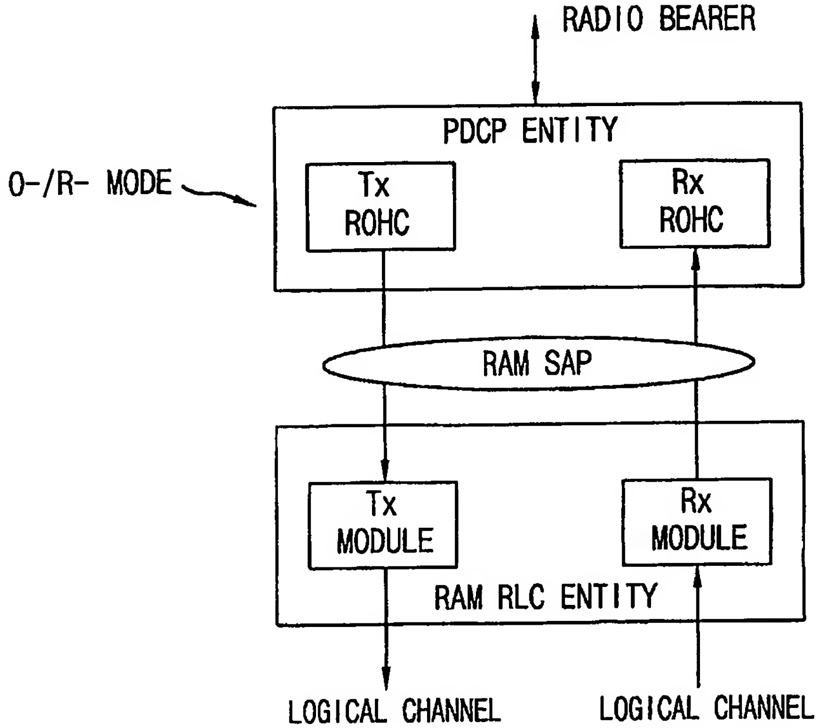

RADIO BEARER
PDCP ENTITY
O-/R- MODE
Tx ROHC
Rx ROHC
RAM SAP
Tx MODULE
Rx MODULE
RAM RLC ENTITY
LOGICAL CHANNEL
LOGICAL CHANNEL

FIG. 8

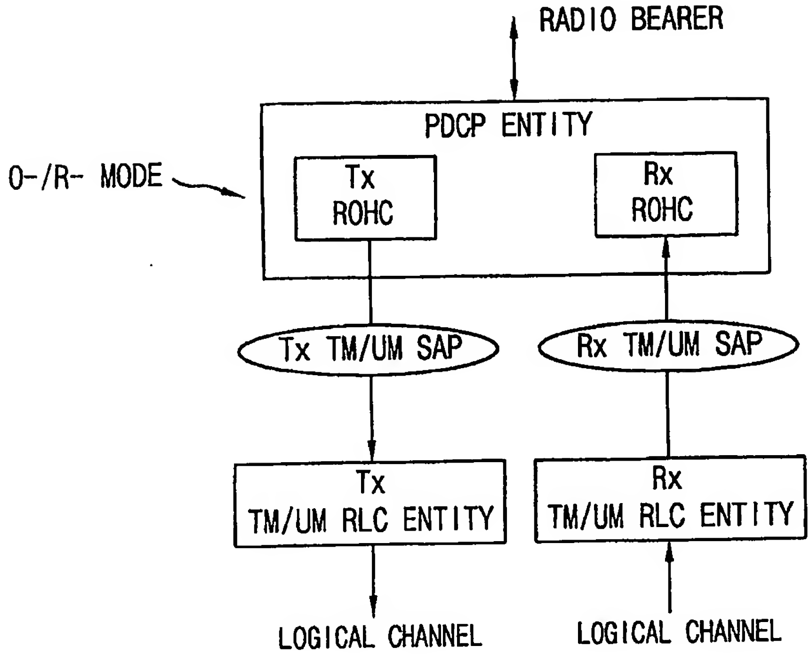
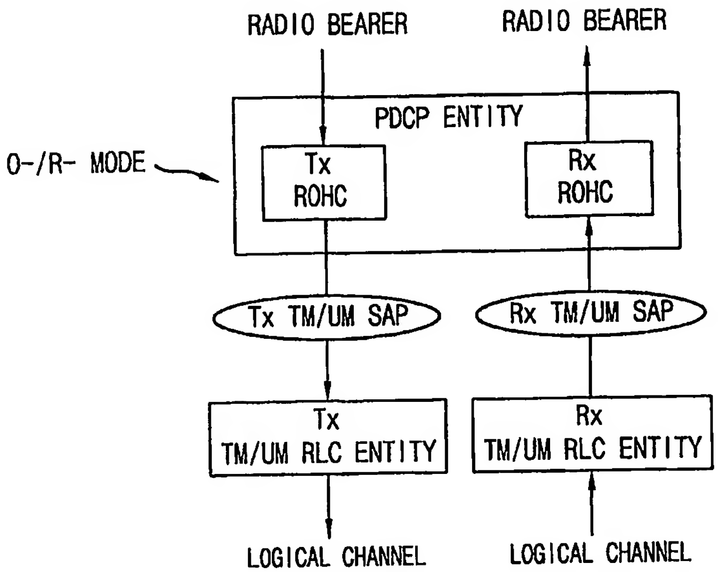

RADIO BEARER
PDCP ENTITY
O-/R- MODE
Tx
ROHC
Rx
ROHC
Tx TM/UM SAP
Rx TM/UM SAP
Tx
TM/UM RLC ENTITY
Rx
TM/UM RLC ENTITY
LOGICAL CHANNEL
LOGICAL CHANNEL

FIG. 9


RADIO BEARER
RADIO BEARER
PDCP ENTITY
O-/R- MODE
Tx
ROHC
Rx
ROHC
Tx TM/UM SAP
Rx TM/UM SAP
Tx
TM/UM RLC ENTITY
Rx
TM/UM RLC ENTITY
LOGICAL CHANNEL
LOGICAL CHANNEL

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR03/00688

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 H04L 12/56

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC7 H04L 12/56

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Korean patents and applications for inventions since 1975
Korean utility models and applications for utility models since 1975

Electronic data base consulted during the intertnational search (name of data base and, where practicable, search terms used)
http://www.espacenet.com(Worldwide Search in the European Patent Office), "RLC and RRC and convergence"
IEE/IEEE Electronic Library (Since 1988), "RLC and RRC and convergence" or "robust and header and compress"

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	UTRA TDD protocol operation Gessner, C.; Kohn, R.; Schniedenham, J.; Sitte, A.; Personal, Indoor and Mobile Radio Communications, 2000. PIMRC 2000. The 11th IEEE International Symposium on , Volume: 2 , 2000 Page(s): 1226 -1230 vol.2	1-90, 100-113, 120-186 91-99, 114-119
X Y	Layer 2 and layer 3 of UTRA-TDD Gessner, C.; Kohn, R.; Schniedenham, J.; Sitte, A.; Vehicular Technology Conference Proceedings, 2000. VTC 2000-Spring Tokyo. 2000 IEEE 51st , Volume: 2 , 2000 Page(s): 1181 -1185 vol.2	1-90, 100-113, 120-186 91-99, 114-119
Y	Efficient and robust header compression for real-time services Khiem Le; Clanton, C.; Zhigang Liu; Haihong Zheng; Wireless Communications and Networking Conference, 2000. WCNC. 2000 IEEE , Volume: 2 , 2000 Page(s): 924 -928 vol.2	1-186

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier application or patent but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents,such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 MAY 2003 (19.05.2003)	20 MAY 2003 (20.05.2003)

Name and mailing address of the ISA/KR	Authorized officer
Korean Intellectual Property Office 920 Dunsan-dong, Seo-gu, Daejeon 302-701, Republic of Korea	KIM, Beom Yong
Facsimile No. 82-42-472-7140	Telephone No. 82-42-481-5684

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR03/00688

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	Robust header compression for real-time services in cellular networks Cellatoglu, A.; Fabri, S.; Worrall, S.; Sadka, A.; Kondoz, A.; 3G Mobile Communication Technologies, 2001. Second International Conference on (Conf. Publ. No. 477) , 2001 Page(s): 124 -128	1-186
P.X. P.Y.	ROHC+: a new header compression scheme for TCP streams in 3G wireless systems Boggia, G.; Camarda, P.; Squeo, V.G.; Communications, 2002. ICC 2002. IEEE International Conference on , Volume: 5 , 2002 Page(s): 3271 -3278 vol.5	1-90, 100-113, 120-186 91-99, 114-119
P.X. P.Y.	On implementation and improvement of robust header compression in UMTS Wang, B.; Schwefel, H.P.; Chua, K.C.; Kutka, R.; Schmidt, C.; Personal, Indoor and Mobile Radio Communications, 2002. The 13th IEEE International Symposium on , Volume: 3 , 2002 Page(s): 1151 -1155	1-90, 100-113, 120-186 91-99, 114-119